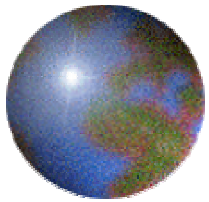

Concurrent and Collaborative Design Approach in NASDA

June 25, 2002

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System Analysis and Software Lab.
National Space Development Agency of Japan

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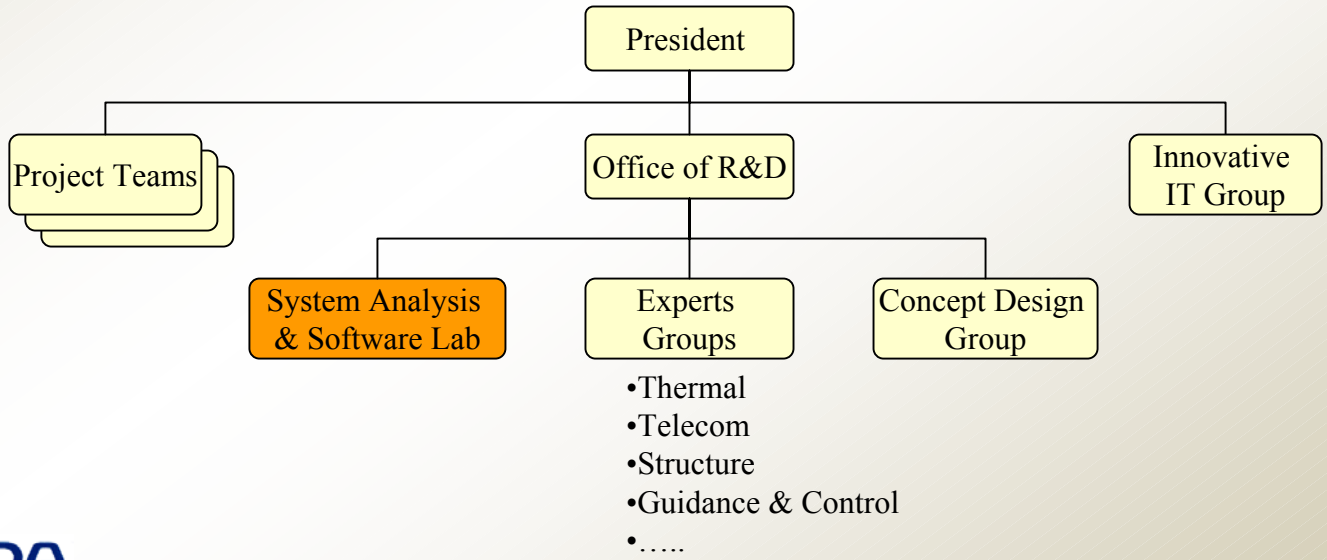
New Design Paradigm in NASDA

- NASDA has just started to establish the New Design Paradigm with support by Dr. Knut Oxnevad from 2001.
- This activity consists of:
  - Concurrent and Collaborative Design Approach
  - Satellite Simulator (Virtual Satellite)
  - Top Down Design Approach



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Concurrent and Collaborative Design Approach

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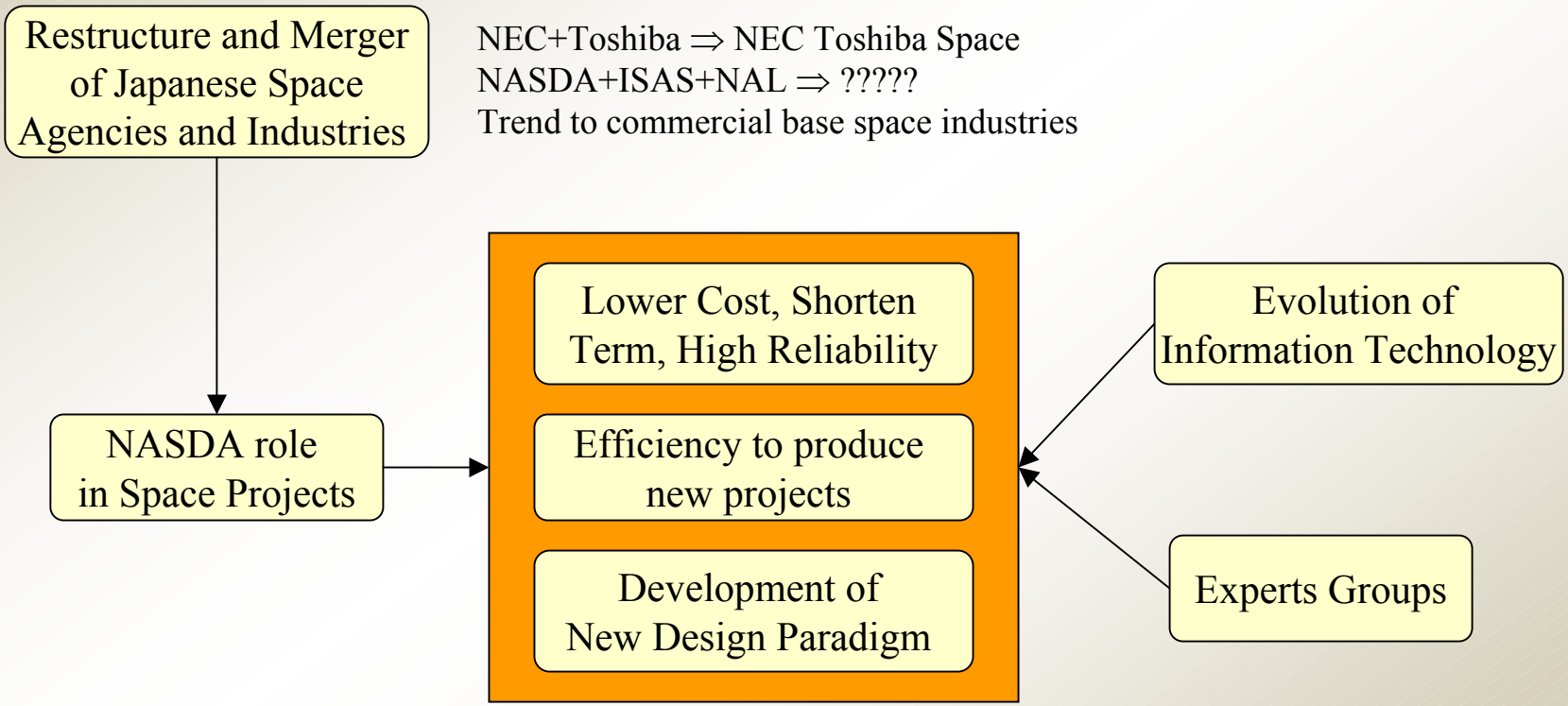
Background


Restructure and Merger of Japanese Space Agencies and Industries
NEC+Toshiba ⇒ NEC Toshiba Space
NASDA+ISAS+NAL ⇒ ?????
Trend to commercial base space industries
NASDA role in Space Projects
Lower Cost, Shorten Term, High Reliability
Efficiency to produce new projects
Development of New Design Paradigm
Evolution of Information Technology
Experts Groups

Focus points

- R&D office focuses on the *mission analysis* and *concept design* process of *new type of missions/projects* more rapidly with precision (as aspect of cost and schedule). *Successful session implementation* is most important task.

- Innovative IT group focuses on *all lifecycle* process starting from concept design, especially for the development of *series' satellites* which means same bus system and same type of missions. Propagating the design process using IT into Japanese Space development companies is also one of high priority tasks.

- In near future, both approaches will be integrated into the unified process and design paradigm.

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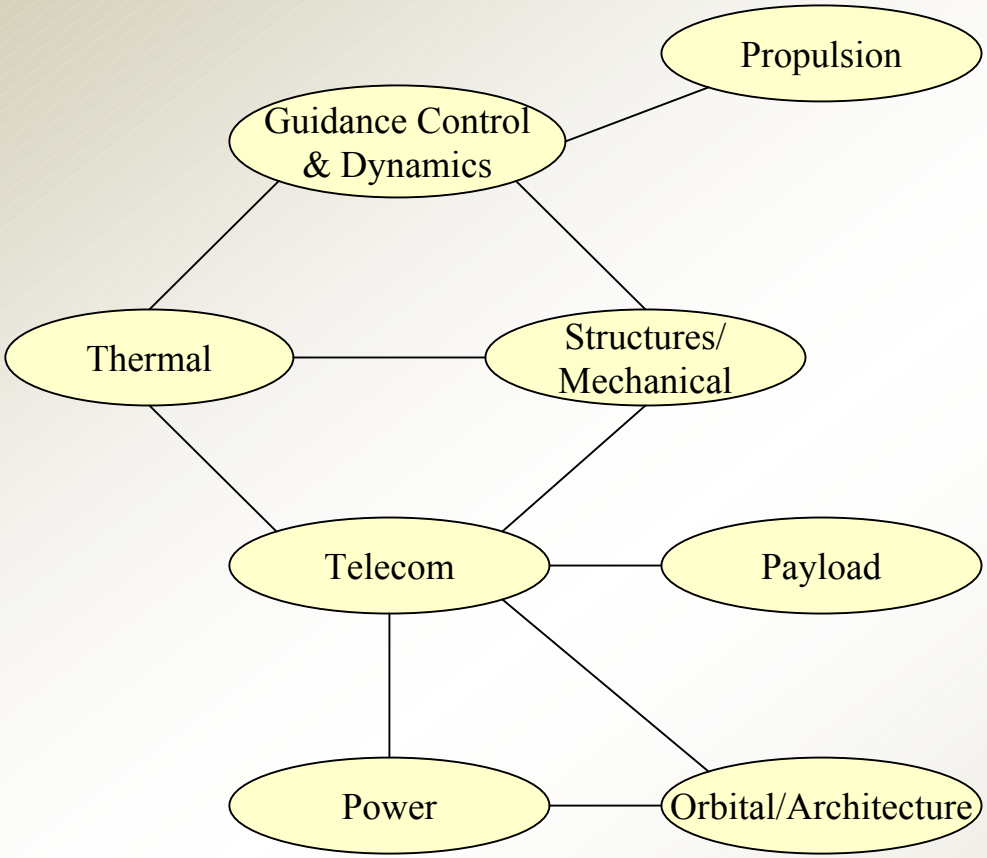
Process Review and Definition

- Process review and definition has been done by last May with Dr. Oxnevad support.
- We interviewed the expert groups on their contributions in traditional design process, especially for mission definition and concept design.
- The interview has not only clearly defined their traditional process, but also given us an opportunity to think about inefficiency of those processes and direction to new process using high-end tools and data.

Interview



Interviewed Expert Groups and possible links

- Interview items:
  - Current processes
  - Analyses to be done
  - Necessary data and source
  - Current tools
  - Skill and depth of work
- Outputs:
  - Process chart
  - Analyses & tools chart
  - Group motivation

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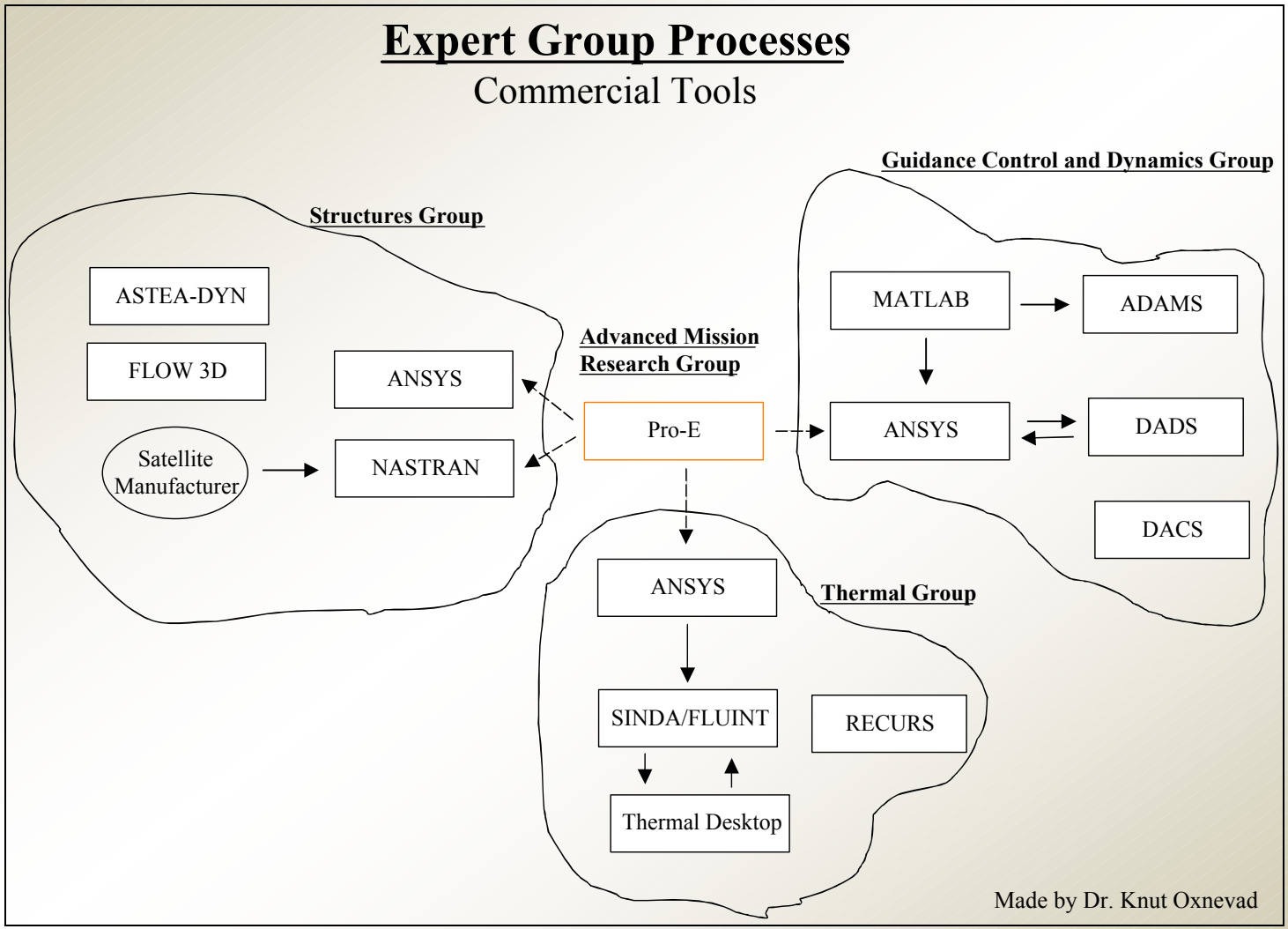
Expert Group Processes

Commercial Tools



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Comparison from Traditional Approach

- Traditional Approach
  - All processes in concept design were done separately in each expert groups and combined into one document (paper).
  - NASDA basically asks several contractors to submit the proposal of the concept design according to NASDA requirements.
  - NASDA only evaluates or analyzes the design proposed by contractors to support the project team.
  - The contractor, in some cases, may redo the concept design at starting preliminary design.
- Concurrent Collaborative Design Approach
  - NASDA can do mission analysis and concept design by ourselves.
  - Real time design session can be performed concurrently with team members from each experts groups, customers, and contractors.
  - Design and analysis information can be transferred to the project team and contractors, and can be shared.

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Demonstration of Concurrent Design Session

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Demonstration of Concurrent Design Session

- Objectives:
  - To test the concurrent design session and environment
  - To understand how to work in concurrent design environment
  - To demonstrate the powerfulness of concurrent design
- In 2002 March
- Coordinated by Dr. Knut Oxnevad

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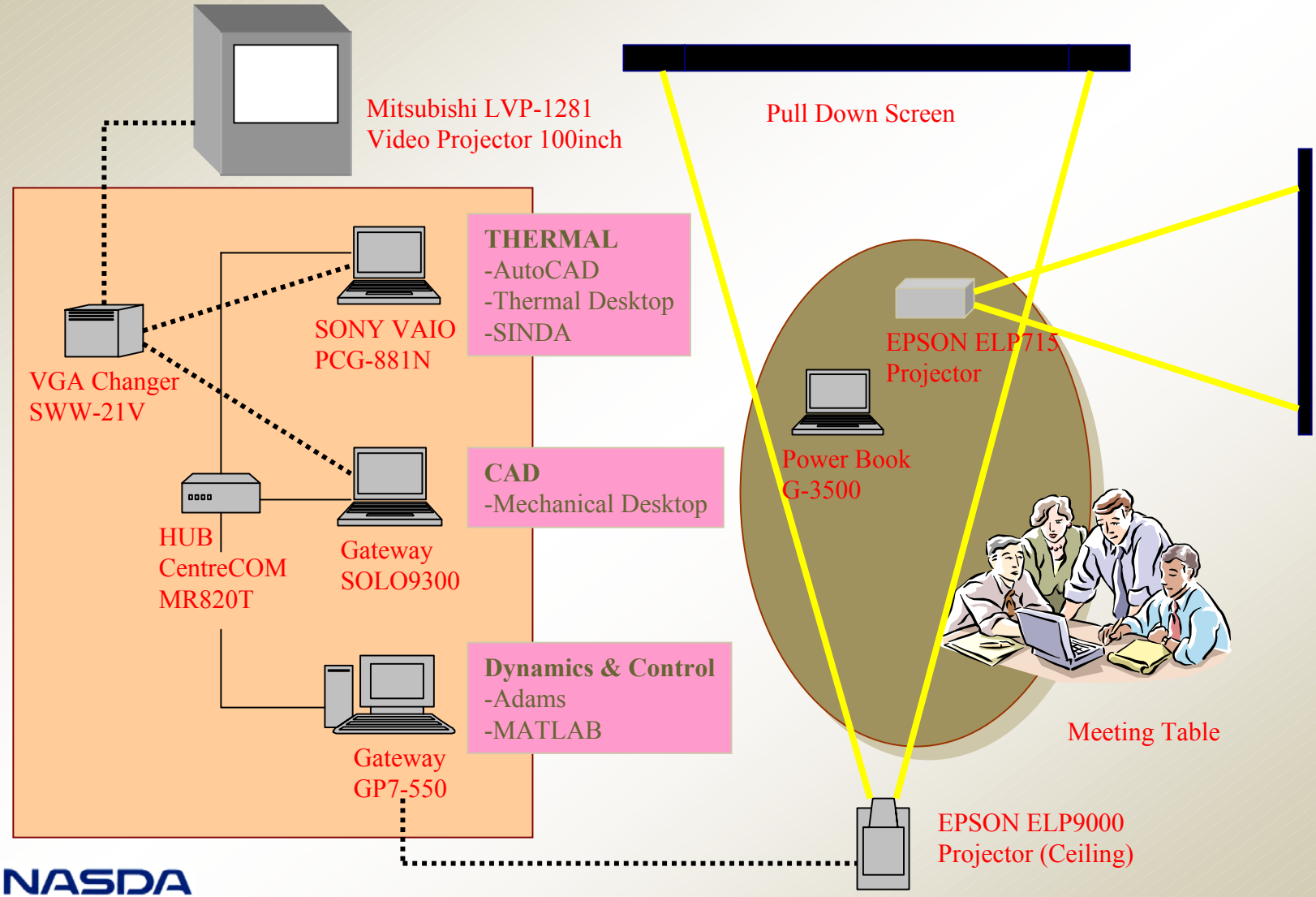
Demonstration of Concurrent Design Session, 2002 March



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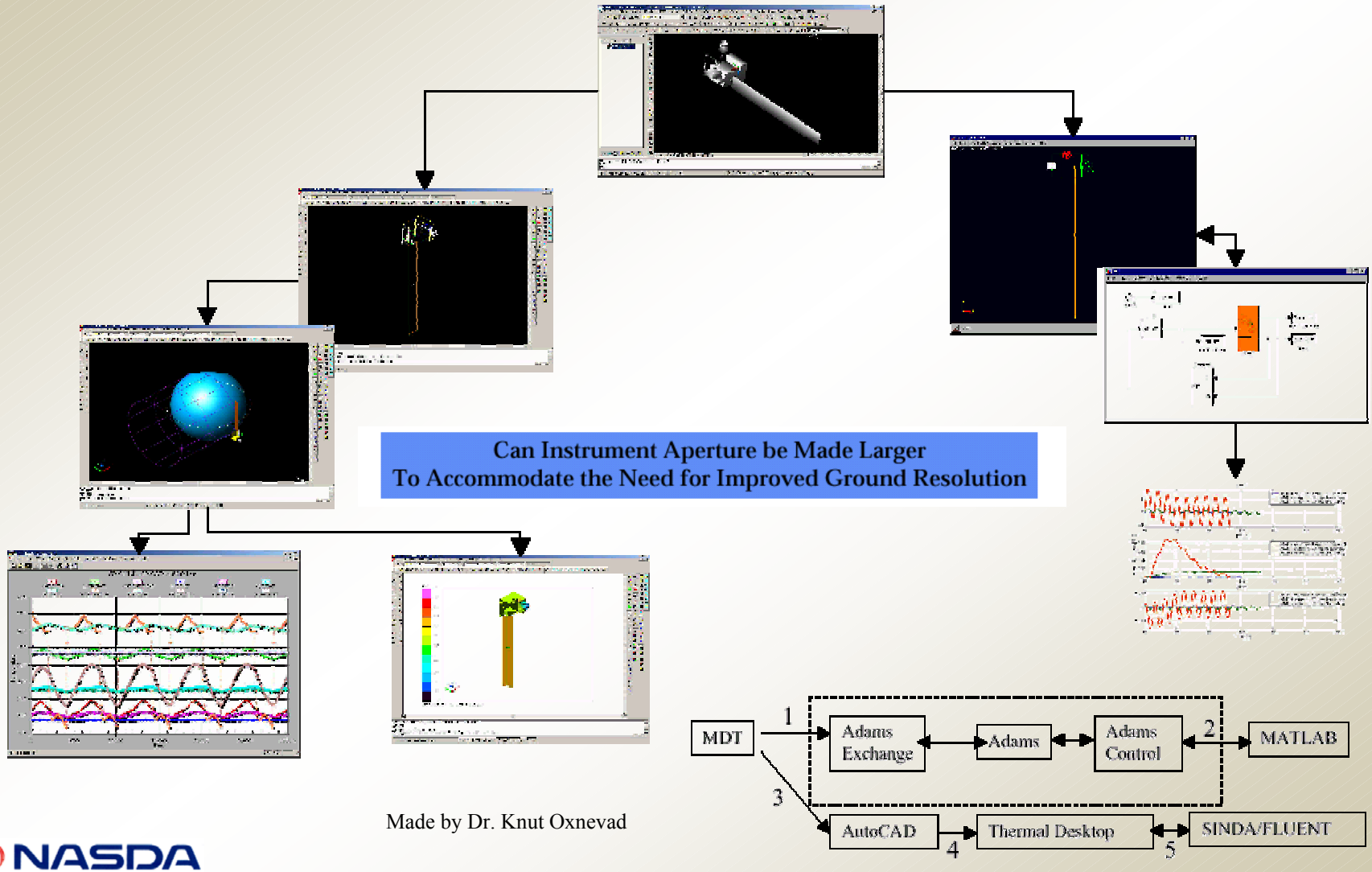
Demonstration of Concurrent Design Session, 2002 March



Made by Dr. Knut Oxnevad

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Findings

- Many findings through the interview and demonstration:
  - Loose (not rigid) coupling between each tools
  - Deep coupling between each processes
  - For higher fidelity design, the new design paradigm allow experts group to realize the more comprehensive analyses will become possible by using high-end tools and data interfaced between tools,

    e.g. thermal impact analysis in the Guidance Control and Dynamics Group when thermal data is available with CAD data.
  - High Dependence on personnel skill in
    - Design and Analysis
    - Utilization of high-end tools

Planning

- As Dr. Oxnevad pointed out in his report, there is three key elements to be considered as well as concurrent and real time environment:
  - Personnel
  - Processes
  - Tools
- Definition of inter-group's and their internal processes in mission analysis and concept design, and related organization
- First real project Design Session in 2002,
  - satellite mission analysis and concept design
  - major experts groups
- Experts Training
  - Design Session
  - High-end tools
- Organization Change and Hiring the experts
- Tools and Stations

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Satellite Simulator (Virtual Satellite)

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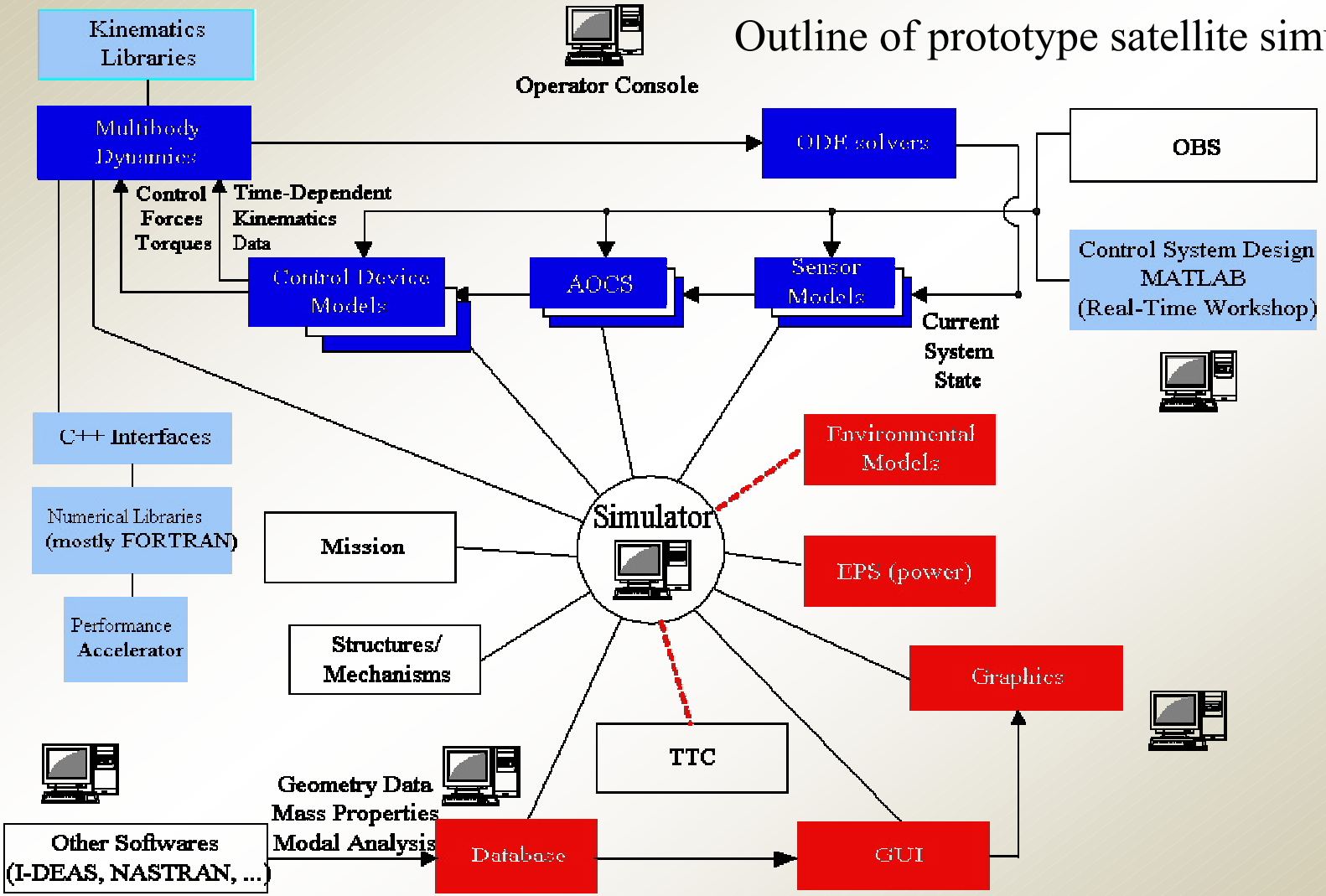
Outline of prototype satellite simulator



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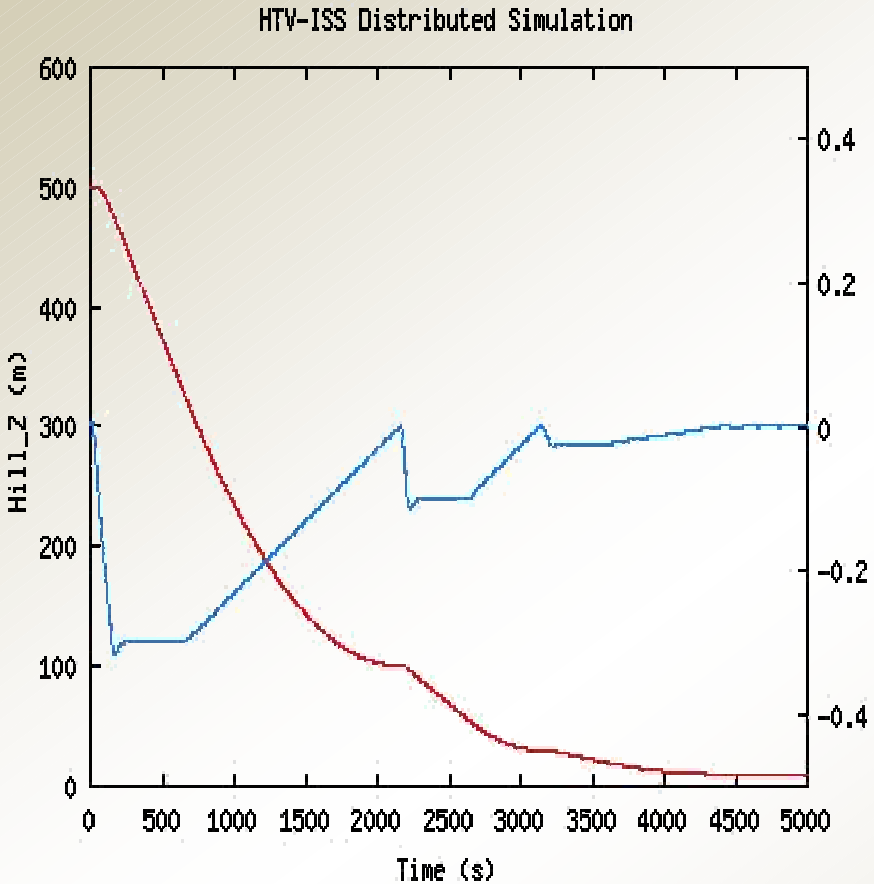
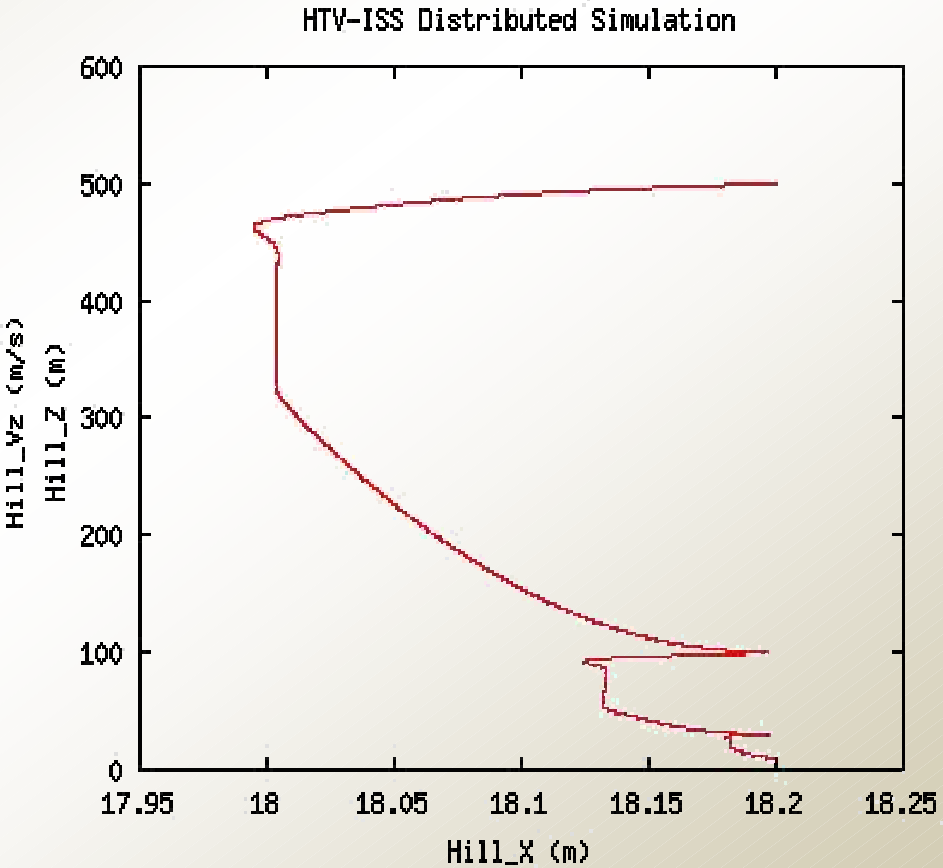
HTV-ISS : sample simulation by HLA simulator



(a)Relative position Z, speed V(time domain)



(b)Relative position X-Z

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Conclusions and Future Works

- NASDA has decided to apply the concurrent collaborative design approach to mission analysis and concept design for the next satellite.
- Establishment of Concurrent Collaborative Design Approach and Satellite Simulator will continue.
  - Trainings
  - Refinement of processes
  - Session Environment including high-end tools
- NASDA also will start studying the system engineering approaches such as the cost effectiveness in concurrent design session.
- Last, NASDA would especially like to thank Dr. Oxnevad for all his support to form NASDA's new design paradigm.